33 TELETYPEWRITER SETS

GENERAL DESCRIPTION AND OPERATION

CONTENTS PAGE

1. GENERAL

1.01 This section provides the general description and operation for Model 33 teletypewriter sets. It is reissued to incorporate the 3300 Series Coded Sets, the

Computer Input-Output (I/O) Sets, and the latest engineering changes. Since this is a general revision, marginal arrows used to indicate changes and additions have been omitted.

1.02 The 33 teletypewriter sets described in this section are electromechanical apparatus that provide terminal facilities for exchanging recorded communication via appropriate transmission facilities, including telegraph lines, telephone networks, and radio channels.

1.03 Terminals in the 33 line are available with either 50 or 60 Hz motors and can use either teletypewriter paper (friction feed) or accommodate multiple-copy business forms (sprocket feed). They operate at 10 characters per second (110 baud), feature four-row keyboards and utilize ASCII (American National Standard Code for Information Interchange). The sets offer a choice of typewheel-keytop combinations and generate alphas, numerics, and many special control codes in even parity. They also provide answer-back on most configurations. Transmission mode may be half or full duplex. Current interface is standard with E.I.A. RS-232-C available as a modification kit.

1.04 Some of the available equipment that may be used with the 33 terminal (see Part 7 for accessories) include a motor control device that will turn the terminal motors on at the receipt of a line signal; also various paper and tape handling devices. The 4210 Magnetic Tape Terminal may be added for on-line data transmission and reception up to 2400 words per minute (240 Hz). A STUNTRONIC* parity error detector may be added to improve data accuracy, and through signal regeneration, to reduce signal distortion from as high as 45 percent down to less than 5 percent. Model 33 sets, with the addition of Teletype station controllers, can be used in selective calling systems.

1.05 References to left, right, up, down, front, rear, etc, consider the teletypewriter set as viewed by the teletypewriter operator.

1.06 This section covers the following teletypewriter sets:

(a) Receive-Only (RO) Teletypewriter Set

(b) Keyboard Send-Receive (KSR) Teletypewriter Set

(c) Automatic Send-Receive (ASR) Teletypewriter Set

(d) 3300 Series Coded Sets

(e) Computer Input-Output (I/O) Set

*Trademark of Teletype Corporation.

2. TELETYPEWRITER SETS

RECEIVE-ONLY (RO) TELETYPEWRITER SET (Figure 1)

2.01 The RO set can only receive messages and print them on a paper copy. It has no transmitting capabilities. Essentially the RO consists of two components.

(a) Typing unit

(b) Call control unit

KEYBOARD SEND–RECEIVE (KSR) TELETYPEWRITER SET (Figure 2)

2.02 The KSR can receive and transmit messages, and print them on a paper copy or sprocket form. It consists of the following components:

(a) Typing unit

(b) Call control unit

(c) Keyboard

AUTOMATIC SEND-RECEIVE (ASR) TELETYPEWRITER SET (Figure 3)

2.03 The ASR set consists of the following components:

(a) Typing unit

(b) Call control unit

(c) Keyboard

(d) Tape punch

(e) Tape reader

2.04 An ASR set can receive and transmit messages. It can print messages on paper copy (or on sprocket form). The tape punch perforates paper tape. The reader senses the code punched in tape which the set can then transmit to the local (itself) or a distant set or sets.

3300 SERIES CODED SETS WITH VARIABLE CUSTOMER ACTIVATED OPTIONS

2.05 A 3300 Series Coded Set (Figures 5 and 6) may be similar to any of the already established sets except that it has been designed and manufactured with or adaptable to the most frequently required features that were previously ordered separately. Most of these features are of the convertible, customer activated option type. The components of these sets are designed so that additional features may be added if desired. For schematic and actual wiring diagrams with circuit description, refer to the Wiring Diagram Package (WDP0316) shipped with the equipment.

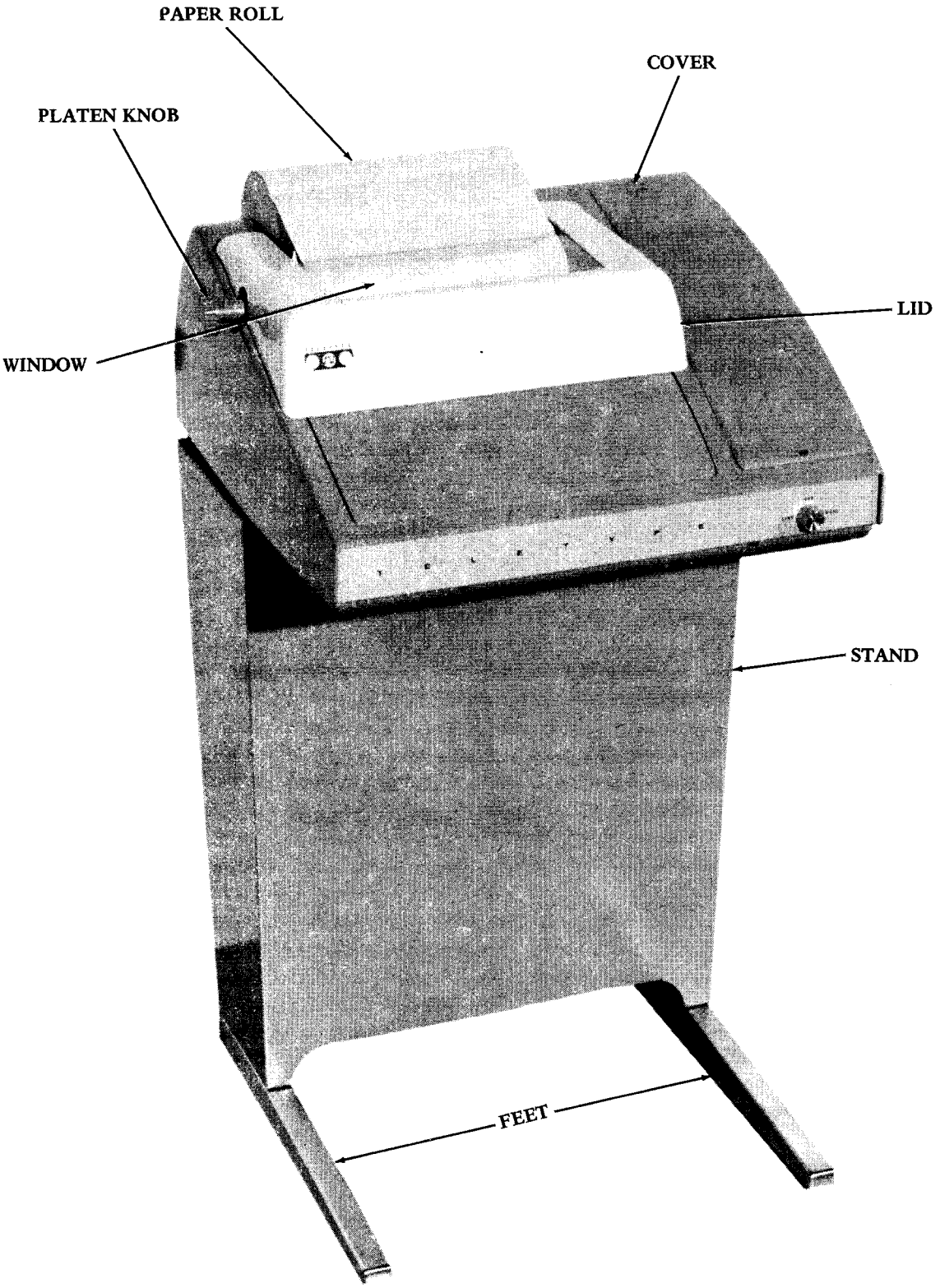


Figure 1 - Model 33 Receive-Only (RO) Teletypewriter Set

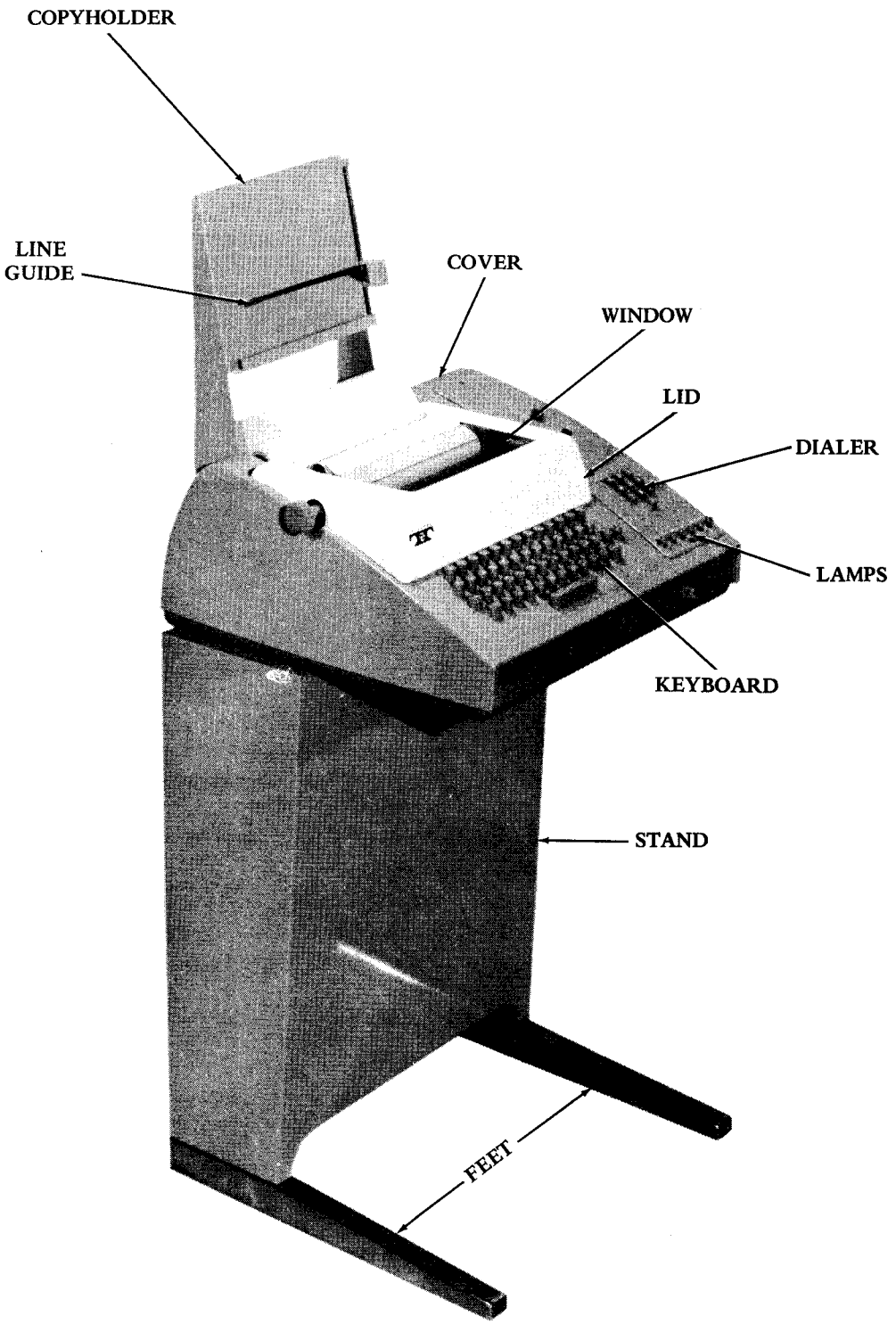


Figure 2 - Model 33 Keyboard Send-Receive (KSR) Teletypewriter Set

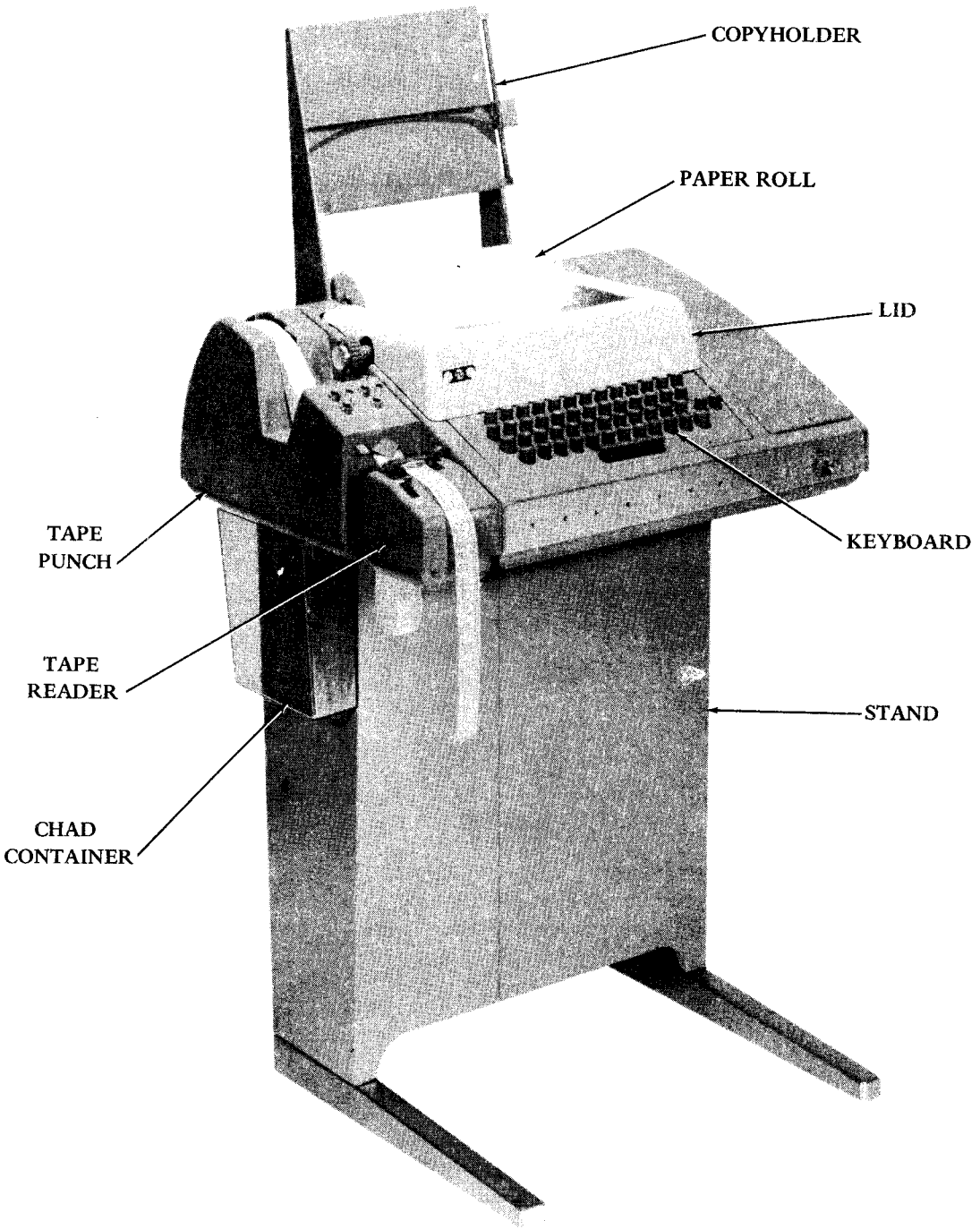


Figure 3 - Model 33 Automatic Send-Receive (ASR) Teletypewriter Set

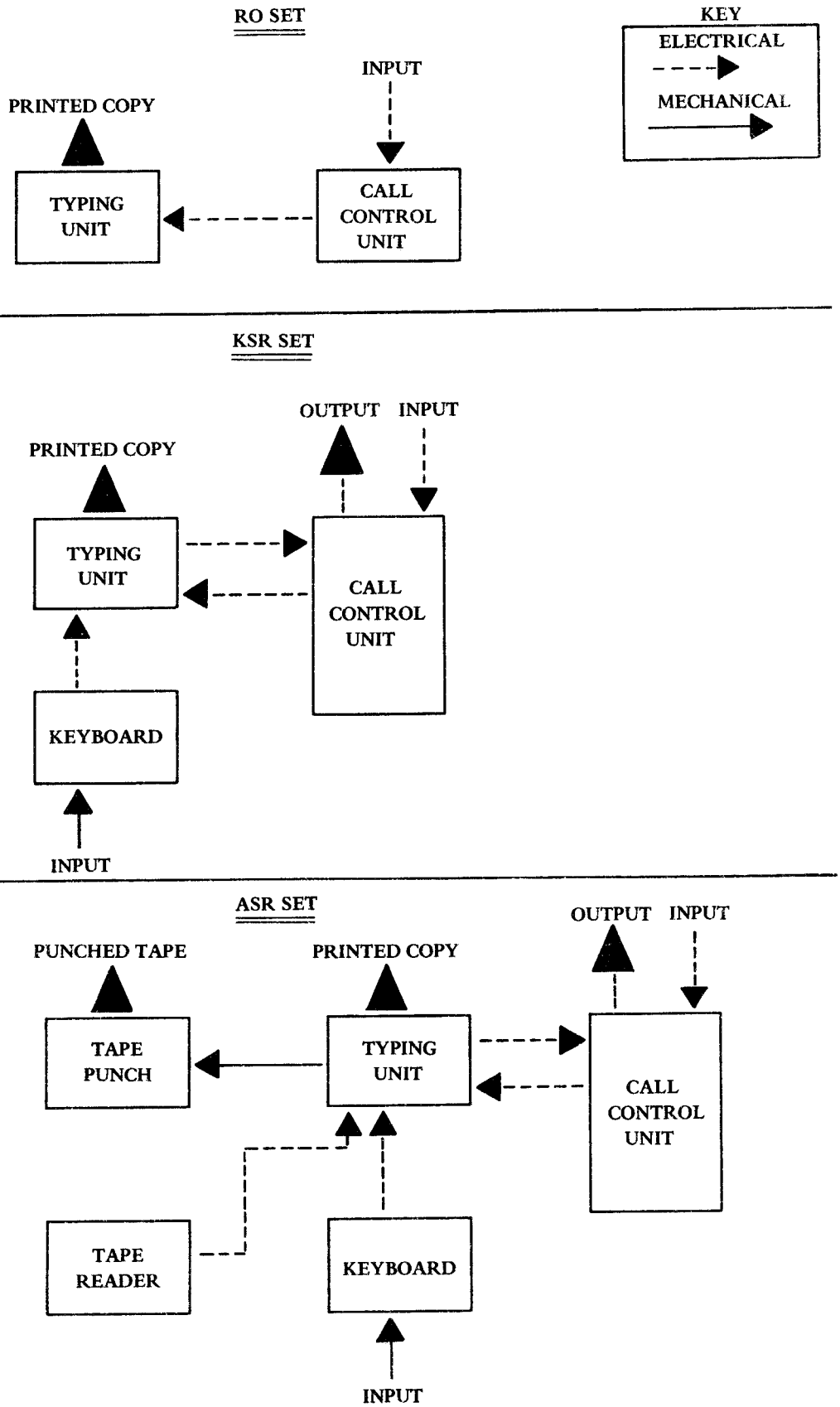


Figure 4 - Block Diagram of 33 Sets

2.06 The 3300 Series Coded Sets introduce a new type wheel and keyboard designed to meet the latest ASCII (refer to Figure 6, and for code description to Section 574-121-100TC). These sets and their components incorporate the following customer activated options:

(a) Automatic/manual (Auto/Man) tape punch

(b) Automatic carriage return and line feed (CR/LF) function

(c) Choice of either automatic/manual (Auto/Man) or manual tape readers

(d) Parity error detection keyboard

(e) Distributor trip mechanism for reader and answer-back magnet options.

2.07 Also included as standard features or equipment in 3300 Series Coded Sets are the following:

(a) Single/double line-feed lever on friction feed typing units

(b) Choice of standard typewheels, presently available

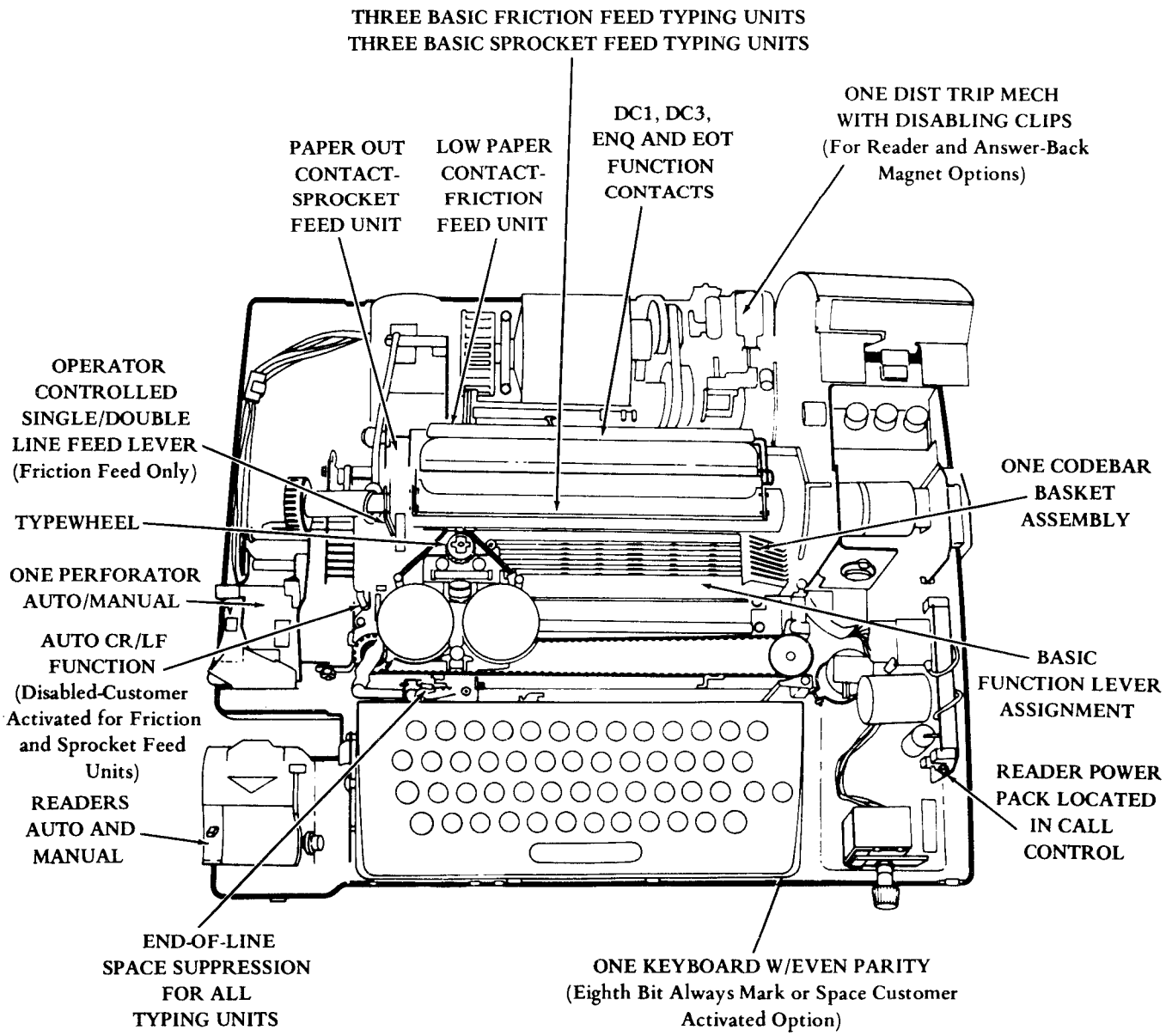
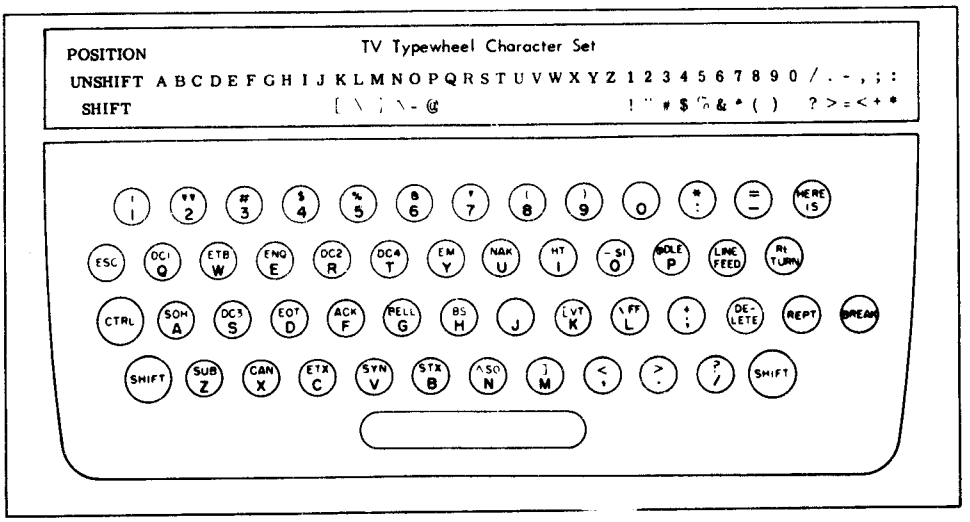
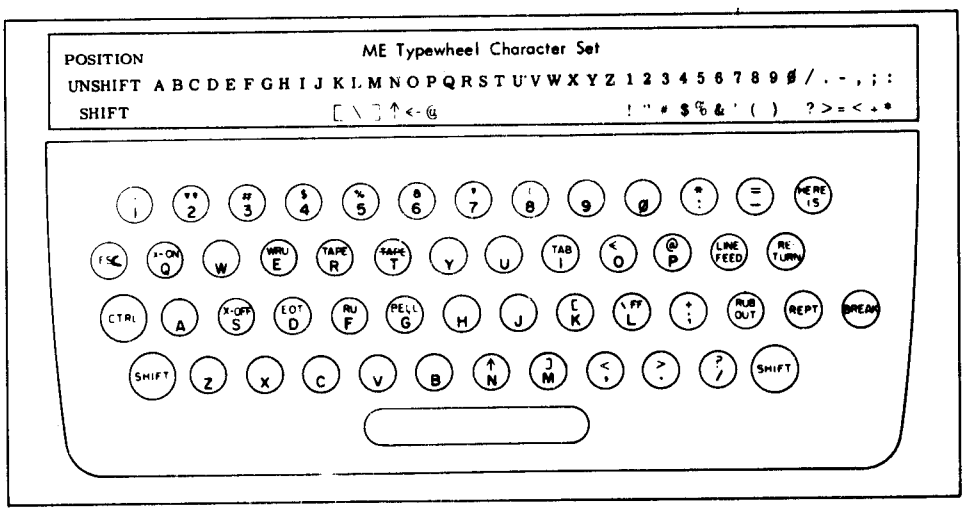


Figure 5 - 3300 Series Coded Set With Cover Removed



FOR ASCII



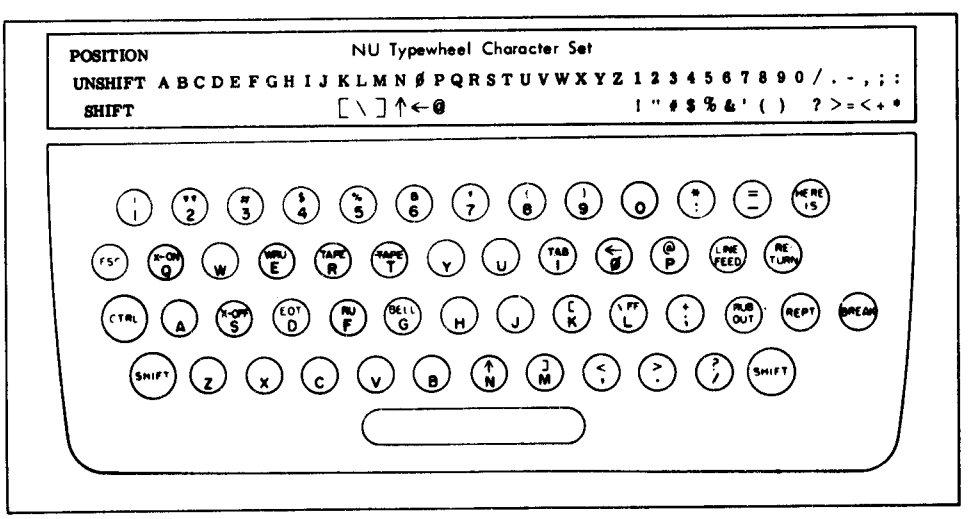


Figure 6 - Typical Typewheel and Keytop Arrangements for 3300 Series Coded Sets

(c) Choice of standard keyboards (to match the typewheels)

(d) End-of-line space suppression for all typing units

(e) Low-paper contact on friction feed typing units

(f) Paper-out contact on sprocket feed typing units

(g) Device control DC1 and DC2, enquiry (ENQ), end-of-transmission (EOT) function contacts

(h) Standard function lever assignment

(i) One standard codebar basket assembly

(j) Reader power pack located in call control unit and enclosed in right side of set cover

(k) Common wiring arrangement and diagrams. Refer to 3.07 for 3300 Series Coded Sets and to the specific sections covering the components for more detailed information.

COMPUTER INPUT-OUTPUT (I/O) SET

2.08 The I/O set is a 33 Automatic Send-Receive Set (Figure 7) that has a special call control unit with 6 manual control key buttons. This set also has a computer interface capability and three solenoids for control of the punch, typing unit, and keyboard in any combination. The set

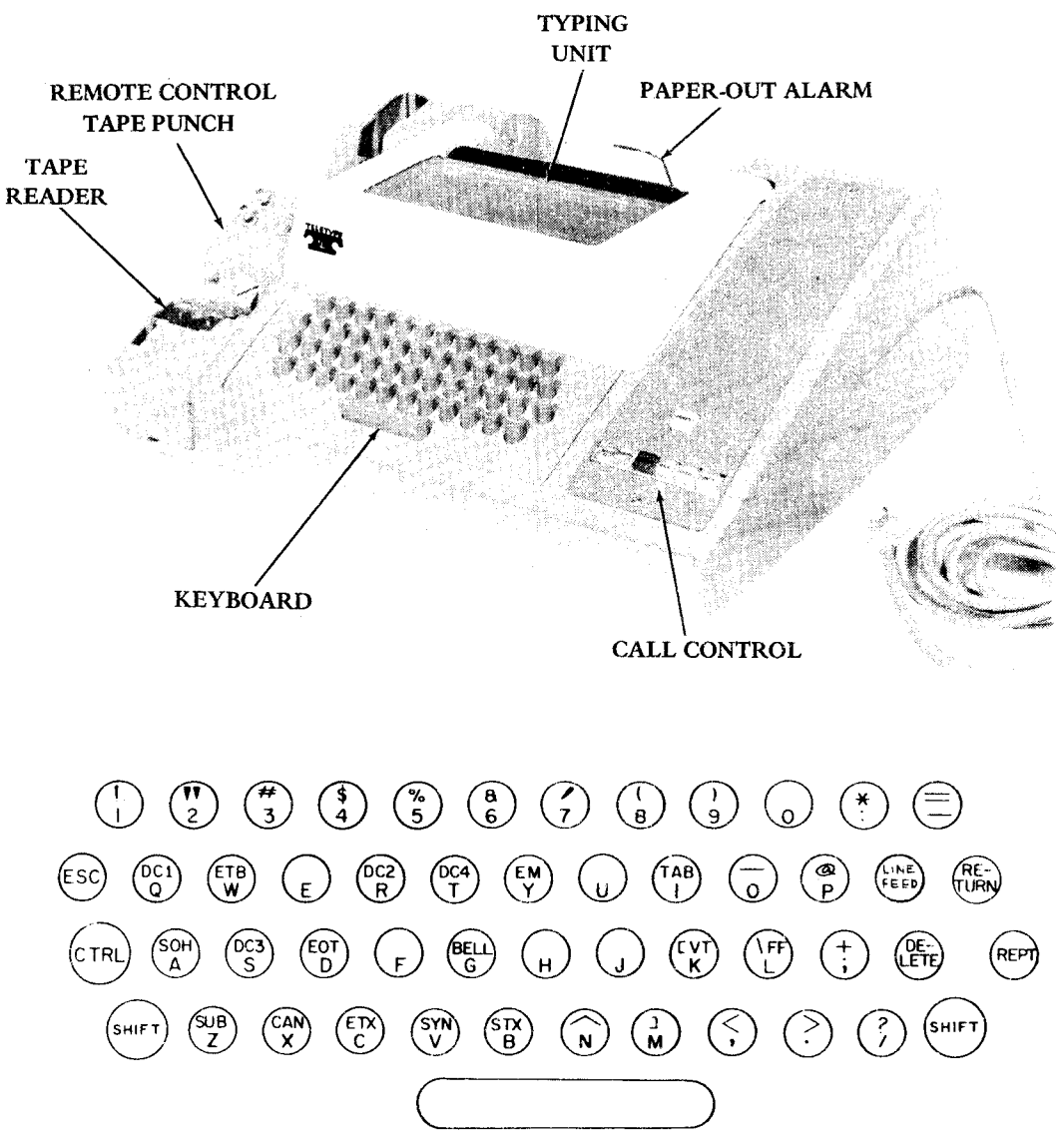


Figure 7 - Computer Input-Output (I/O) Set and Keyboard Arrangement (TP184771)

may be controlled either locally by the operator or remotely by a computer. The I/O sets are available for either 50 or 60 hertz operation.

2.09 An I/O set, when used with a computer, serves as a console operators input/output device and as a computer slave. These sets are intended primarily for use as remote controlled data input/output terminals. Each set operates on an 8-level, 100 wpm (110 baud), ASCII, even parity code.

2.10 Each I/O set consists of a page printer, keyboard, tape punch, tape reader, low tape switch, control unit, and cover.

2.11 These I/O sets provide two modes of operation: local and remote. In local, the printer will monitor keyboard or tape reader generated signals. A PUNCH ON/OFF switch controls the punch in the local mode. In remote, the punch, the signal generating unit, and the monitoring unit are controlled remotely (eg, by a computer).

2.12 A 20-pin connector and cable connects the terminal to the computer. The interface consists of data in and out, control, and terminal status.

3. COMPONENTS

33 SETS

3.01 In this section, only a brief outline of component operation will be presented. Individual components are described in detail each in a separate section. Refer to the following for a general description and principles of operation of the components:

Typing Unit	574-122-100TC
Call Control Unit	574-123-100TC
Keyboard	574-121-100TC
Tape Punch	574-125-100TC
Tape Reader	574-124-100TC

A. Typing Unit

3.02 The typing unit is the receiving component of the set. A signal coming into the typing unit is translated into a mechanical arrangement of codebars. The position of these codebars determines two things: the position of a typewheel upon which characters are embossed, and the selection of functions such as CARRIAGE RETURN and LINE FEED. A motor, by means of a main shaft, supplies all the motive force to effect the printing and perform the functions. The friction feed set may be considered the standard type of set. It handles 8-1/2 inch paper, and will accommodate 74 characters per line, 10 characters per inch. Vertically the friction feed set will print 6 lines per inch and will normally print one original and one copy.

B. Call Control Unit

3.03 The call control unit serves as a bridge to electrically join the set to the communication networks. In some applications the call control unit serves to initiate, accept, control and complete the incoming calls. A power supply, local-remote control circuits, a selector magnet driver circuit, and a motor delay timer circuit are some of its basic elements.

C. Keyboard

3.04 The keyboard is the sending component of the set. Each of its keys controls an arrangement of levers which, in turn, position electrical contacts to represent the character. The keyboard output is a parallel output to the distributor of the typing unit. The distributor senses the keyboard output and sends it in a serial form to the selector magnet driver. From the selector magnet driver it then goes to the typing unit selector.

D. Tape Punch

3.05 The input to the tape punch is strictly mechanical. Extensions on the typing unit codebars position themselves in the tape punch to set up a similar coded arrangement of punch pins. With drive motion from the typing unit main shaft, the tape punch drives the punch pins to perforate holes in paper tape.

E. Tape Reader

3.06 Sensing pins in the tape reader are driven upward for every cycle. Where holes are present in the tape the sensing pins close a set of contacts. Where no holes are present in the tape the sensing pins are blocked and make no contact. These current, no-current conditions are duplicated on the typing unit distributor as a parallel output. The distributor senses the condition of each pulse and sends it serially to the selector magnet driver in the call control unit. From the call control unit the pulses go to the typing unit to print the character.

3300 SERIES CODED SETS

3.07 In order to increase compatibility with respect to special features and included options, new or changed versions of set components have been released. Wherever possible (after precautionary check for compatibility with present equipment) it is recommended that this

series be ordered for new or replacement 33 equipment (Figure 5). Combined schematic and actual wiring diagrams for this equipment are available in the single Wiring Diagram Package WDP0316. Refer to Section 574-100-201TC for set installation instructions.

A. Typing Unit

3.08 The following features and options are included as part of the basic 3300 Series Coded Set components:

(a) Either friction or sprocket paper feed, as ordered.

(b) A TP186790 "A" codebar, TP186783 extension clip for friction feed printers and a TP186803 extension clip for sprocket feed printers (Figure 8) provide the end-of-line (EOL) bell and automatic carriage return (ACR)-line feed options. (Refer to appropriate related sections for detailed description, installation and adjustments.) On the friction feed printers the clip provides EOL bell on the 71st character and ACR-line feed on the 72nd character. The clip on the sprocket feed printer provides EOL bell on the 71st character and ACR-line feed on the 72nd character (Figure 8). The sprocket feed printer has a maximum line length of 72 characters.

(c) Stop clips to block (disable) unwanted functions (Figure 9).

(1) The TP186781 and TP186782 stop clips were designed to block the function levers from sensing their printer codebars.

(2) The TP186781 function lever stop clip is a short clip and is used in the related function box numbered slot. That is, the clip is placed over the slot of the codebar basket tie bar which is in direct line with the numbered function box slot. The TP186782 function lever stop clip is a long clip and is placed over the related letter slots of the codebar basket (Figure 9).

(3) To enable automatic carriage return-line feed in a friction feed type unit, a stop clip is not provided over slot "A". When the function is to be disabled the stop clip is placed over slot "A" of the codebar basket.

(4) To inactivate the automatic carriage return-line feed functions in a sprocket feed typing unit, a TP186872 stop clip is placed over the related slot "A" and also slot "L" of the codebar basket tie bar. The function lever in slot "A"

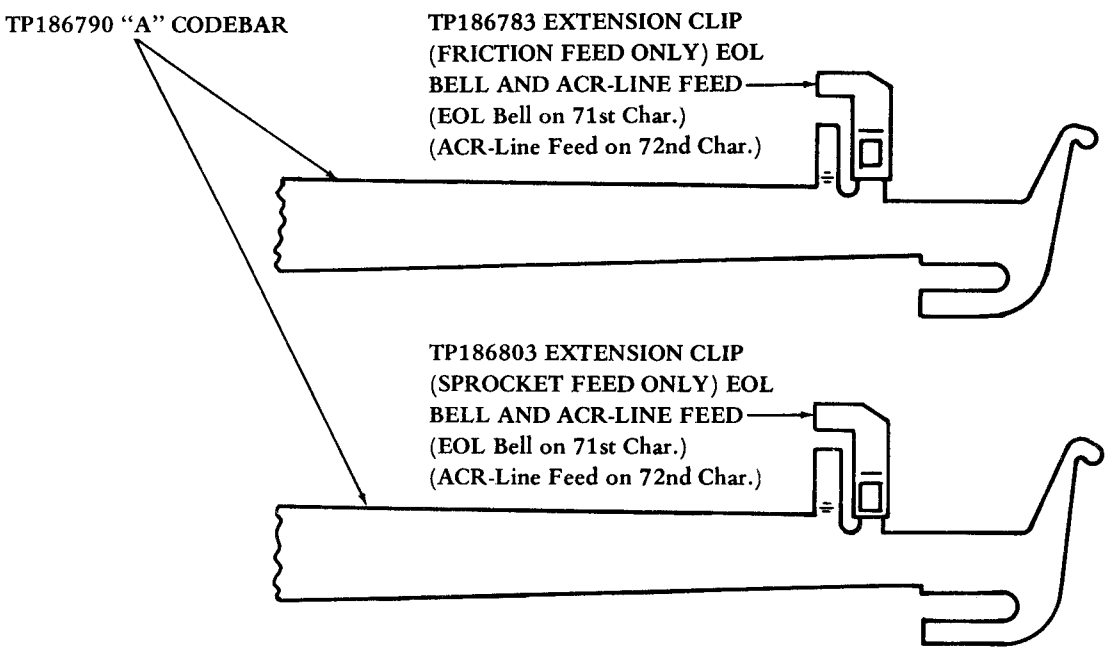
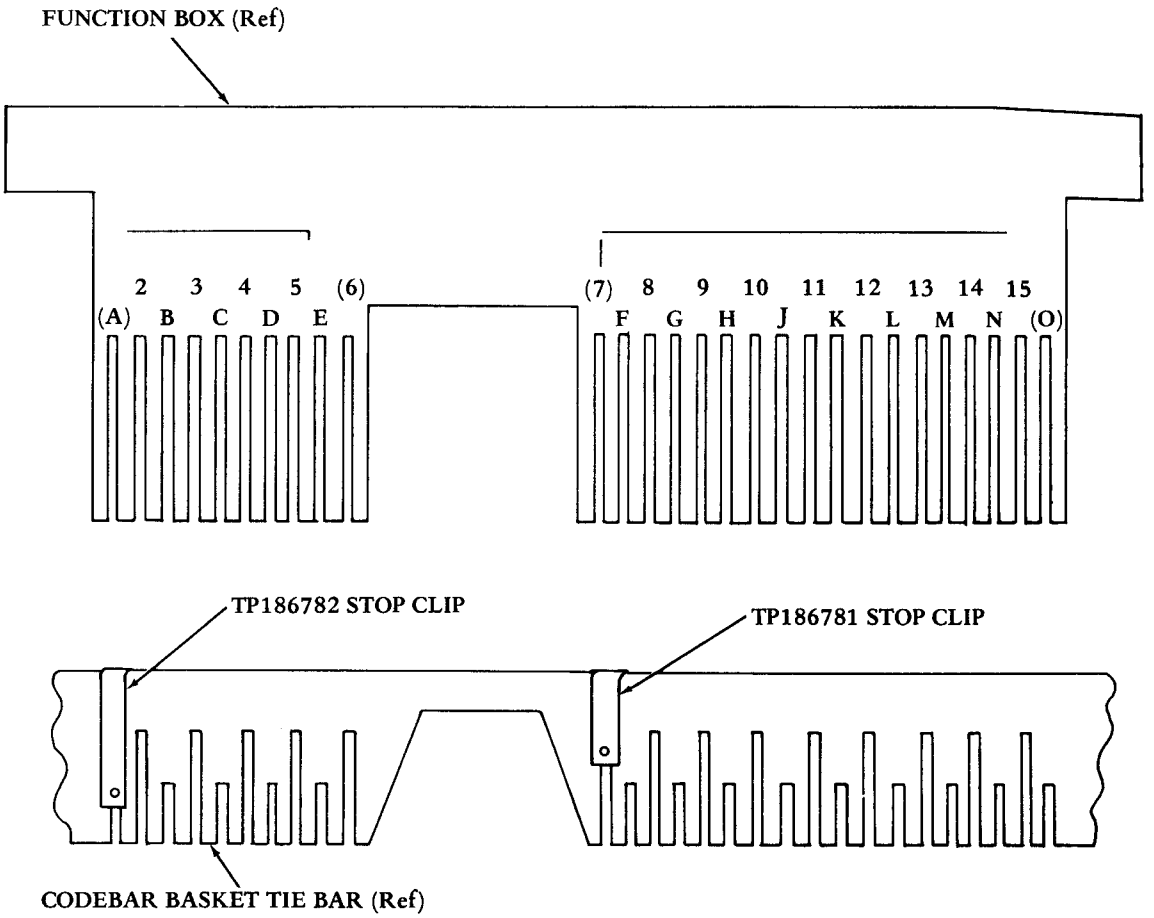


Figure 8 - Codebar With End-of-Line (EOL) Bell and Automatic Carriage Return (ACR)–Line Feed Extension Clips for 3300 Series Coded Sets



Note: Characters and numbers in ( ) are not moulded in function box casting.

INSTALLATION OF FUNCTION LEVER STOP CLIPS

Figure 9 - Stop Clips to Block Unwanted Functions

performs the automatic carriage return function and the function lever in slot "L" performs the automatic line feed function.

(5) To activate the two functions for ACR-LF in sprocket feed units, the stop clips are removed.

Note: The TP186781 or TP186782 stop clips cannot be used on typing units incorporating the print nonprint feature using the TP183565, TP183566 and TP183567 blocking bars in their codebar baskets.

(6) To enable the margin bell and end-of-line bell, a function lever stop clip is not provided in slot "F" of the codebar basket.

(7) To disable the margin bell and end-of-line bell a function lever stop clip is placed over slot "F" of the codebar basket.

(8) If margin bell is required and no automatic carriage return-line feed and end-of-line bell is required, the TP186783 "A" codebar extension for friction feed units or TP186803 extension clip for sprocket feed units is removed. When end-of-line bell is a requirement, the margin bell is also a requirement. Both functions are operated from the same function lever.

Note: The stop clips may be used to block other function levers located in the right side of the codebar basket. The stop clips, if removed, should not be reused. A new clip should be installed.

(d) Stop plate for ASR sets without tape reader trip magnet option and for KSR and ASR sets without answer-back trip magnet option (Figure 10):

(1) The TP186873 stop plate is intended for use in the transmitter distributor and answer-back trip magnet area.

(2) The stop plate provides an optional feature for selection of three different voltage type magnets for transmitter distributor or answer-back trip operation. To select and add one of the three magnets for transmitter distributor or answer-back trip feature, their associated armature, armature extension, and hardware must also be added.

(3) The function of the stop plate prevents the TP183098 clutch trip lever or the TP180843 answer-back trip lever from operating when either the transmitter distributor trip or answer-back magnets and associated armature parts are absent.

(4) The TP186873 stop plate is installed in either the transmitter distributor trip lever magnet position or answer-back position or both (Figure 10).

B. Call Control Unit (Figure 5)

3.09 An already established 8-level, call control unit in the 3300 Series Coded Sets performs the basic functions of connecting the printer, keyboard, and reader for use on private line types of dc signal line loops. This unit incorporates the following features:

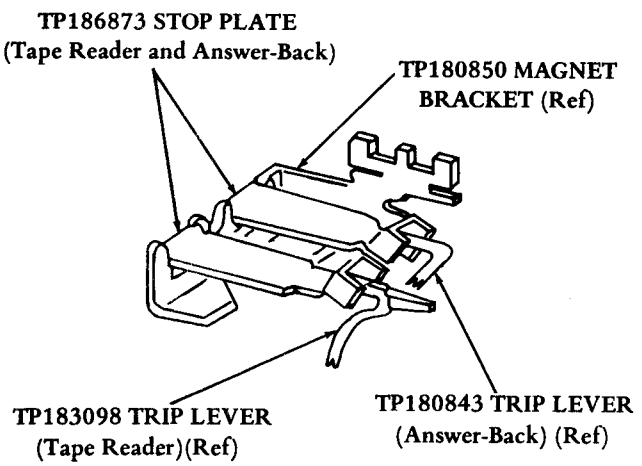


Figure 10 - Stop Plate for Tape Reader and Answer-Back Trip Levers of 3300 Series Coded Sets

(a) Self-contained power supply to provide local battery for off-line functions

(b) Local-line power switch

(c) Selector magnet driver assembly capable of either 0.020 amp or 0.060 amp neutral operation

(d) Convenience outlet

(e) Fuses

(f) Provisions for mounting additional components

(g) Signal line filter

(h) Wiring provisions for full duplex operation

(i) Wiring provisions for parallel input and output.

The manual control knob (Figure 11) for the line-local power switch is located at the front of this unit. (Additional call control unit information is available in Section 574-123-100TC.)

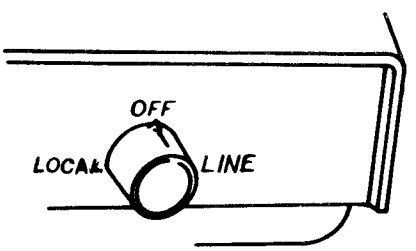


Figure 11 - Set Control Knob

C. Keyboard (Figures 5 and 6)

3.10 This keyboard is wired at the factory for even parity which the customer may optionally rewire for 8th bit always marking or always spacing (no parity). Refer to Wiring Diagram Package WDP0316. The keyboard also introduces a keytop arrangement that is compatible with the ASCII, and a matching typewheel (Figure 6).

D. Tape Punch (Figures 5 and 12)

3.11 The tape punch for 3300 Series Coded Sets incorporates the customer activated option of automatic operation. The automatic option is activated by removal of the two factory installed TP187001 disabling clips (Figure 12) from slots A-0 and A-8. The manual controls are not disabled and may still be used for operation or to override the automatic functions if desired. The automatic

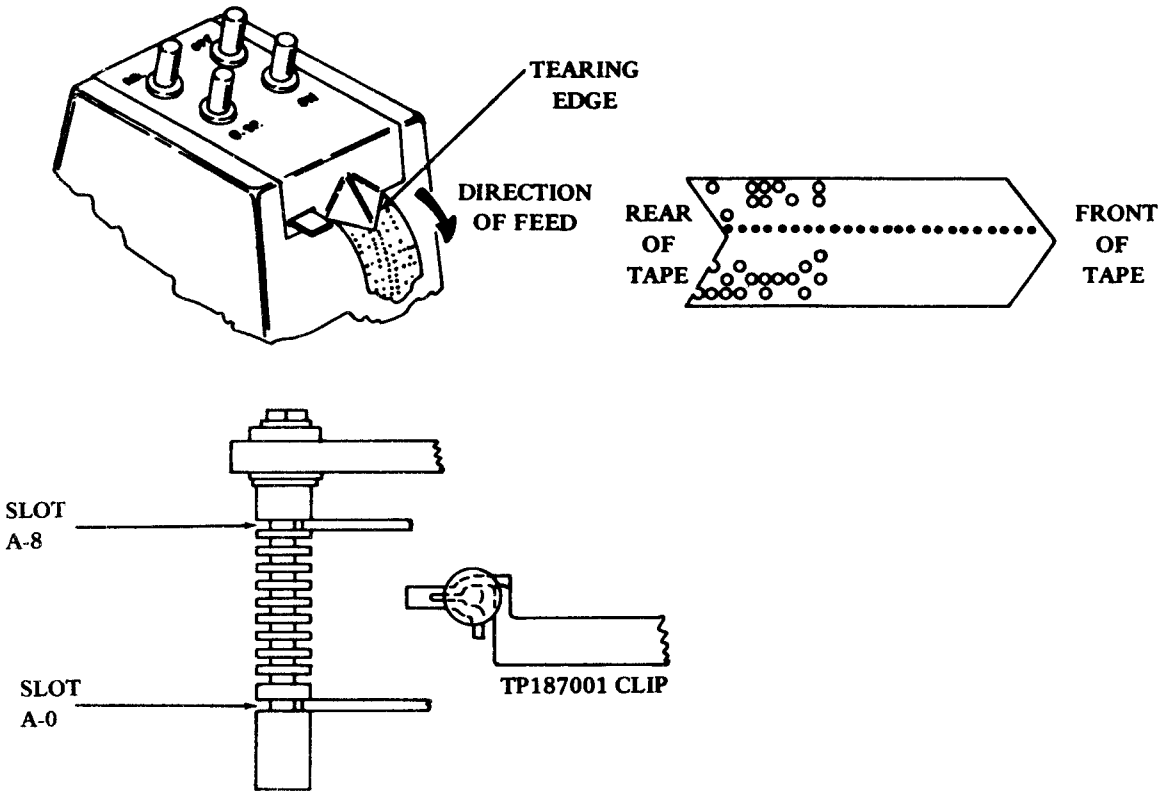


Figure 12 - Model 33 Auto/Manual Tape Punch for 3300 Series Coded Sets

functions may be disabled by reinstalling the clips. (Refer to Section 574-125-100TC for more detailed description and to Section 574-100-201TC for installation instructions.)

E. Tape Reader (Figures 5 and 13)

3.12 There is a choice of either a manual or an automatic/manual tape reader for the 3300 Series Coded Sets (Figure 13). The power pack that was formerly located outside of an ASR set is now located in the call control unit as shipped from the factory (Figure 5). If desired, this power pack may still be moved out of the set in order to install other special equipment. Operation and controls of these tape readers are as follows:

(a) Manual Operation:

START – Reader will run in this position until turned off, end of tape is reached, or the tight tape switch is operated.

STOP – Reader is inoperative in this position.

FREE – Disengages tape feed mechanism. Allows operator to pull tape through the reader for positioning.

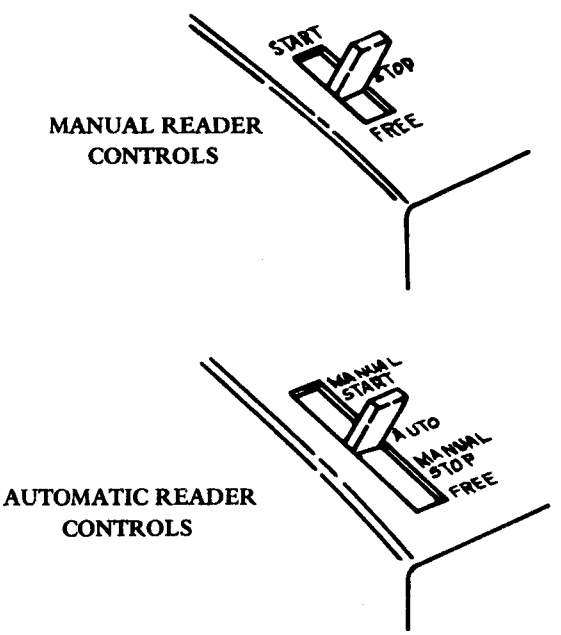


Figure 13 - Choice of Model 33 Tape Readers for 3300 Series Coded Sets

(b) Automatic Operation:

AUTO – (Automatic mode) spring biased handle is normally in automatic position, so automatic mode is assumed unless operator intervenes. The reader will respond to ASCII controls as follows:

DC1 – Automatically turns reader on.

DC3 – Automatically turns reader off.

ENQ – Stops reader and calls in answer-back. If DC1 is received at the end of the answer-back transmission, the interrupted reader will automatically restart.

MANUAL START – To activate reader without receiving the signal code DC1, the operator moves handle to MANUAL START position. Reader will then operate, with switch returning to AUTO position when released.

MANUAL STOP – To stop the reader, the handle is moved to MANUAL STOP position. Handle will return to AUTO when released.

FREE – Allows tape to be moved manually, for repositioning. Switch must be returned manually from this position to AUTO.

Control Characters – Two delete characters must follow each control character in paper tape.

TIGHT-TAPE Switch – When the tape becomes tight or tangled, the TIGHT-TAPE switch turns off the reader and thus prevents tearing the tape.

TAPE-OUT Switch – When the end of a tape is sensed, the TAPE-OUT switch turns reader off automatically. Makes it possible to turn the reader on and walk away without fear of needless reader operation.

COMPUTER INPUT-OUTPUT (I/O) SET

3.13 The following paragraphs describe significant features of the components in an I/O set (Figures 7 and 14). For schematic and actual wiring diagrams with circuit description, refer to the wiring diagram package (WDP) shipped with the equipment.

A. Typing Unit

3.14 This unit has a remote control print, nonprint solenoid (Figure 14) which suppresses printing and spacing upon command from the computer. The solenoid leads, along with those of the distributor trip magnet, selector magnet, and low paper contacts terminate in the number five molex connector. The distributor circuitry terminates in the number two molex connector.

3.15 The typing unit prints on 8-1/2 inch wide (maximum) rolled paper. Maximum paper roll is 5 inches in diameter. Vertical spacing six lines per inch.

3.16 One color printing is provided at ten characters per inch, 72 characters per line, printing upper case alpha characters. Upper case foldover occurs for printing of upper case equivalents of lower case ASCII characters (refer to Section 574-121-100TC for description of code).

3.17 An operator adjusted single or double line feed feature is provided.

3.18 An ASCII "bell" character received, provides an audible alarm to the operator.

3.19 Automatic carriage return (CR) and line feed (LF) at the end of line after the 72nd printed character is provided. A two character buffer is required following the 72nd character if additional printing characters follow at or near 100 wpm. Otherwise, printing during carriage return will occur.

3.20 Margin bell on the 61st character and end-of-line bell on the 71st character is provided.

3.21 Low paper contacts are present on the typing unit.

3.22 No function box contacts are provided.

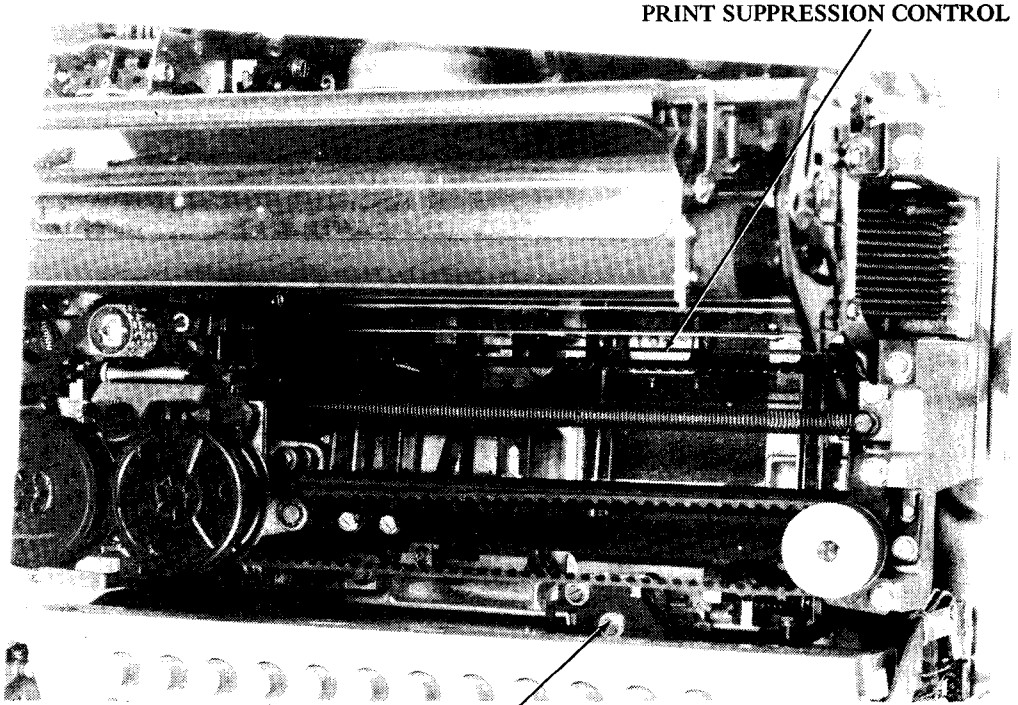
3.23 The motor, gear train, and fan are protected by a safety shield.

B. Call Control Unit

3.24 The I/O control unit (Figure 15) provides the electrical interconnection of the various terminal components, the interface, and control circuits. The unit consists of a circuit board, power supply, and operator control switches.

C. Keyboard

3.25 The computer input-output (I/O) 33 keyboard includes a solenoid-operated locking mechanism (Figure 14) which permits remote control of the keyboard by the computer. The locking mechanism blocks the keyboard universal lever to inhibit the distributor cycle and thus prevent any keyboarded code characters from being transmitted. The keylevers are operative in the locking mode, but the related code combinations are not stored. (See Figure 7 for a diagram of the keytop layout used on this version of the keyboard.)



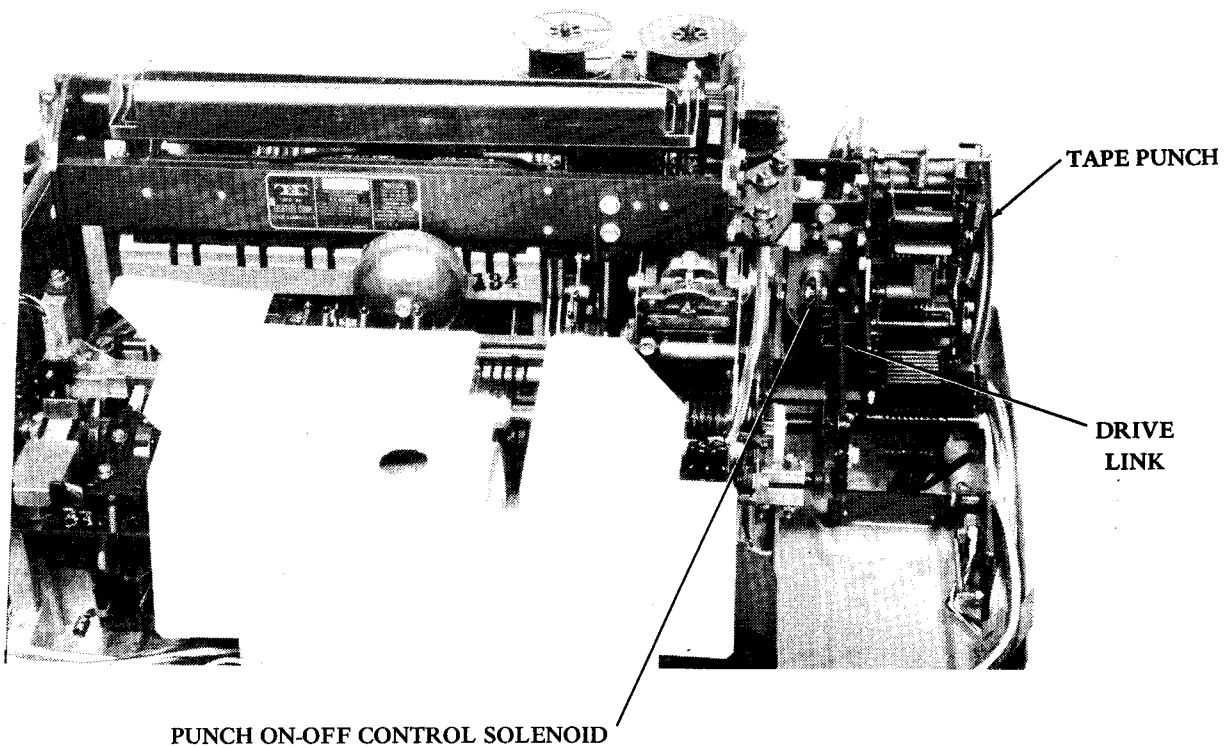
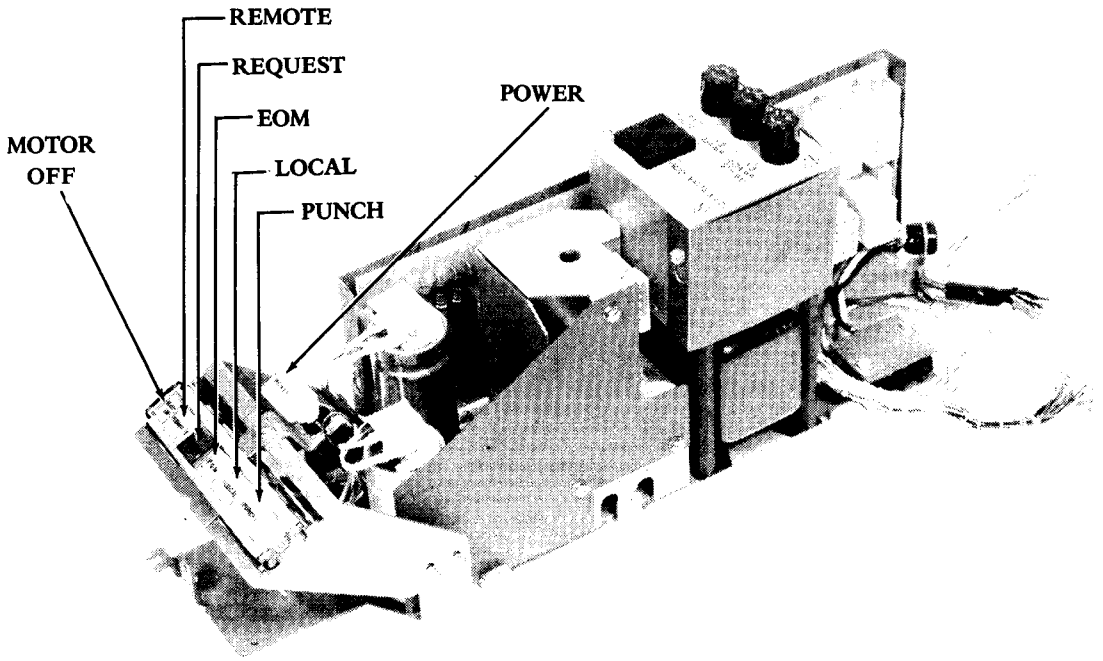


Figure 14 - Computer I/O Set Control Solenoids



COMPONENT LAYOUT AND CABLE ROUTING

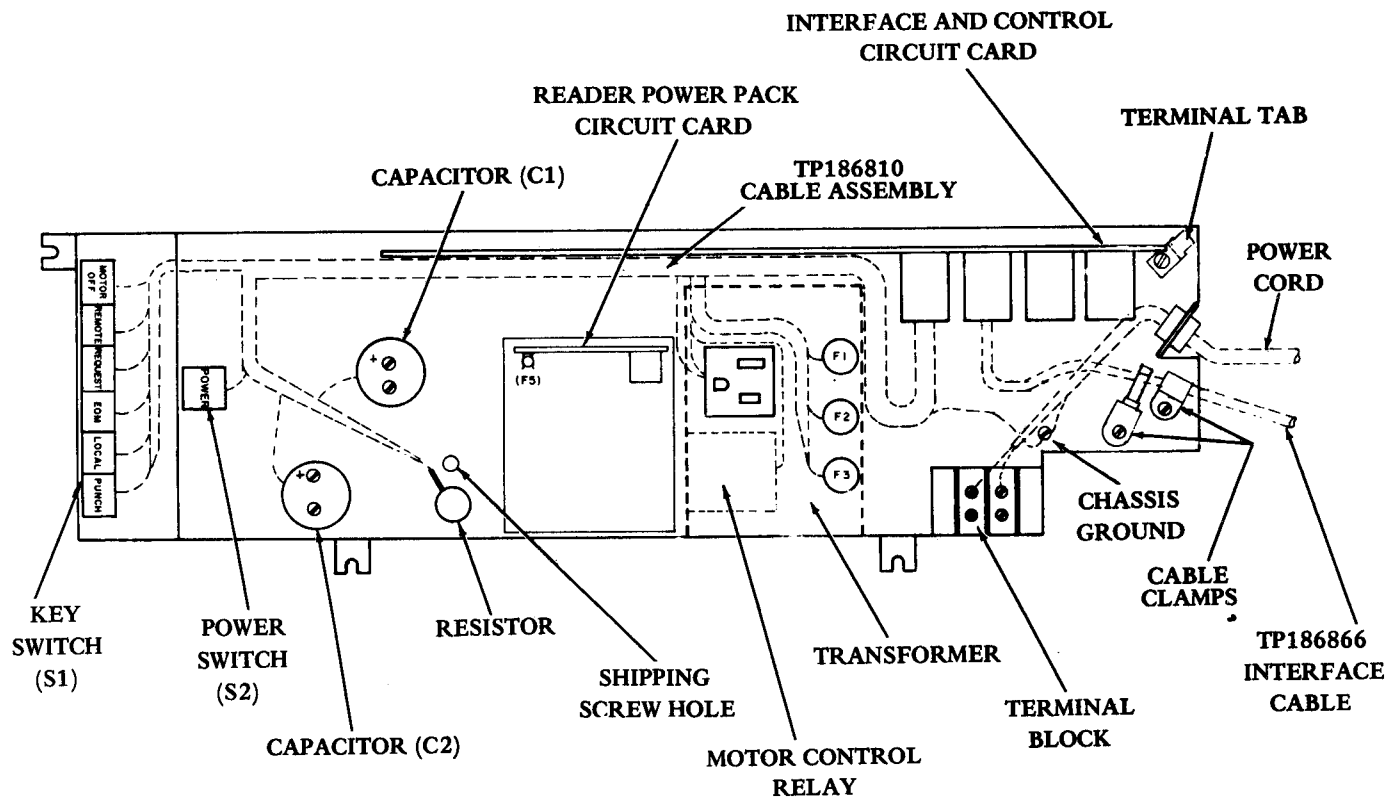


Figure 15 - I/O 33 Control Unit Removed From Set and Cable Diagram

3.26 Control is provided by the continuous duty solenoid mounted on the back of the keyboard frame (Figure 14). This solenoid is energized by a 48 v dc ±10% signal from the computer. When energized, the plunger is pulled into the coil, and through an operating lever, causing a camshaft assembly to rotate. As the shaft assembly rotates, the cam surface drives the universal lever of the keyboard downward, below the bottom surface of the latchlever. With the universal lever held in this position, the distributor clutch tripping mechanism in the printer is disabled.

3.27 To activate the distributor, the solenoid is de-energized by removal of the 48 v signal. The plunger is pulled out of the coil by a return spring and the mechanical linkage pivots the camshaft assembly counter-clockwise. The universal lever moves upward to the bottom surface of the latchlever, and normal distributor control action is restored.

3.28 The solenoid energization and key depression need not be synchronized in any manner. If during a key depression, the lock is energized, the lock will activate on a subsequent key depression. Conversely, if during a key depression, the lock is de-energized, the distributor will be tripped and the character transmitted.

D. Tape Punch

3.29 The I/O set 33 tape punch for remote control operation (Figures 7 and 14) differs from other 33 tape punches in that it includes a solenoid to activate the mechanism. The punch is turned on or off by an electrical signal from the computer (remote mode), or by the PUNCH ON/OFF button on the set control switch assembly (local mode). The manual ON and OFF buttons on the cover of the standard punch are not present on the remote control punch.

3.30 The solenoid mechanism is mounted at the right front of the punch. The connecting leads are routed along the left side and rear of the ASR set pan and terminate at the printer connector.

3.31 The solenoid operates at +48 v ±10% at a nominal current of 105 milliamperes. The "on" condition is that in which the solenoid is de-energized. The "off" condition is produced by energizing the solenoid.

E. Tape Reader

3.32 The I/O set tape reader is similar to other manual readers (Figures 7 and 13, 3.06 and 3.12) except that for remote control purposes the clutch trip circuitry and tight-tape/tape-out contact are connected to an external connector.

4. SET FEATURES

4.01 Functions – Functions refer to nonprinting operations performed by the set which are supplementary to its purpose of printing characters. All sets are equipped for the following functions.

CARRIAGE RETURN – Upon command to CARRIAGE RETURN the movable printing mechanism returns to the left margin.

LINE FEED – Advances the paper or sprocket form one or two lines.

SPACE – Every character printed is spaced a certain distance from the previous one automatically. However the set can accept a separate command to SPACE in which case it will move the printing mechanism one character space to the right.

SPACE SUPPRESSION – In some instances, such as when commands to CARRIAGE RETURN or LINE FEED are given, the set spacing mechanism is suppressed and no spacing occurs. Spacing is suppressed on all functions, except the SPACE function.

PRINT SUPPRESSION – The printing mechanism is suppressed so that no printing occurs when the set receives commands to perform any of the functions.

BLANK – The BLANK function serves to suppress printing.

4.02 Even Parity Keyboard – The 33 sets use seven intelligence pulses to accommodate the code combinations of ASCII. The remaining eighth pulse is used as an error detection device. In sets so equipped the even parity keyboard adds an eighth marking pulse whenever the number of marking pulses in a code combination is odd. If the number of marking pulses in a code combination is even, the eighth pulse is transmitted as a spacing pulse. This means that every code combination transmitted by the even parity keyboard has an even number of marking pulses.

Note: Keyboards not equipped with the even parity feature always transmit the eighth pulse as a marking pulse.

4.03 Numeric Keyboard – As the name implies, this optional feature consists of a keyboard with a numeric arrangement. It has no letters. This restricts the set for specialized applications where the exchange of data is of a numeric nature. Besides the numeric arrangement, the keyboard also transmits nonprinting functions such as EOT (end-of-transmission), SPACE, DELETE, CARRIAGE RETURN, LINE FEED, etc.

4.04 Answer-Back – In sets equipped with this feature, a mechanism coded with a predetermined sequence of characters is used for identification purposes. The mechanism may be actuated locally or remotely.

4.05 Automatic Carriage Return-Line Feed – This feature may be found on friction feed sets only; sprocket feed sets are unable to accommodate it. In sets so equipped, as printing approaches the end of the line the printing mechanism is returned to the left margin and the paper is advanced one line vertically.

4.06 Sprocket-Feed – Sprocket feed sets print characters on a sprocket fed form. Although the forms are 8-1/2 inches wide, they may be 6, 7, 8-1/2, 9, 10, or 11 inches in length. A total of 72 characters may be printed in a line on the form, with 10 characters per inch. The set will accommodate 6 lines of printed characters per inch. Varying with the weight of the carbon, the set will normally print one original and two copies. When the set has used all the forms available, an alarm will disable the set from accepting incoming calls.

4.07 Form-Out (Sprocket Feed Only) – In sets so equipped, the form-out mechanism advances the forms to a predetermined length upon command. The mechanism is adjustable to various form lengths.

4.08 Paper-Out Alarm (Sprocket Feed Only) – A set equipped with this feature will activate an alarm when the supply of forms is exhausted. The set will also refuse to accept any other incoming calls.

4.09 Low Paper Alarm (Friction Feed Only) – When the amount of paper on the roll reaches a certain amount, a switch activates an alarm which indicates to the operator that the paper supply is low.

4.10 Automatic Punch Controls – This feature allows a number of operating modes for turning the tape punch ON and OFF. The tape punch can be turned ON and OFF manually or automatically. An ON-LOCK feature which locks the tape punch in the ON mode is also available with the automatic punch.

4.11 End-of-Line Bell – Sets with this feature alert the operator that the printing mechanism is approaching the end of the line at the right margin.

4.12 Print-Nonprint – This solenoid mechanism disables a set so equipped from printing or performing functions when operated. When unoperated the set can print and execute its operations in normal fashion.

4.13 Line Break – This feature places the set so equipped in an open line condition. A BREAK key on the keyboard effects the operation.

4.14 Repeat – Sets equipped with this feature can print a character or perform a nonprinting function continuously when the REPEAT key is depressed on the keyboard together with another key.

4.15 TD Call In – An ASR set having this feature can activate the tape reader of a distant set by momentarily closing a set of contacts. The tape reader can also be activated in two other ways: By closing a set of X-On (Reader On) contacts and by manually placing the tape reader in the ON mode.

4.16 Copyholder – The feature consists of a metal frame equipped with a page indicator. The frame mounts on the back of the set, facing the operator. Messages to be transmitted may be placed on the copyholder for convenience during transmission.

4.17 End-of-Transmission (EOT) – When equipped with this feature the sending set can indicate to the receiving set that the entire message has been sent out and transmission is terminated. The keyboard has an EOT key which will activate the mechanism.

4.18 Accessories – A number of accessories are available with the set, including the following:

(a) A sheet metal stand which supports the subbase and components at a convenient operating level. It consists of chrome feet, equipped with leveling screws or roller casters, and an enclosure to house auxiliary apparatus, such as a data set and the tape reader power pack.

(b) Call control facilities, including buttons, indicator lamps, motor control relay, speaker, ringer, buzzer, and rotary, TOUCH-TONE®, or card dialers.

5. TYPICAL OPERATION AND APPLICATION

33 SET OPERATION

5.01 The following is a brief description of how 33 Teletypewriter Sets, equipped with call control and answer-back features, may be used in a typical communication system (Figure 16). When a call is to be made, an operator uses the controls on the teletypewriter set to gain access to the system switching and transmission facilities, which may be dial telephone or telegraph networks. The operator then dials the number of the called station.

5.02 The switching center selects the proper station and signals the receiving station, indicated by visual and/or audible indicators. Using the controls on the teletypewriter set, the operator at the called station completes the connection and conditions the equipment so that communi-

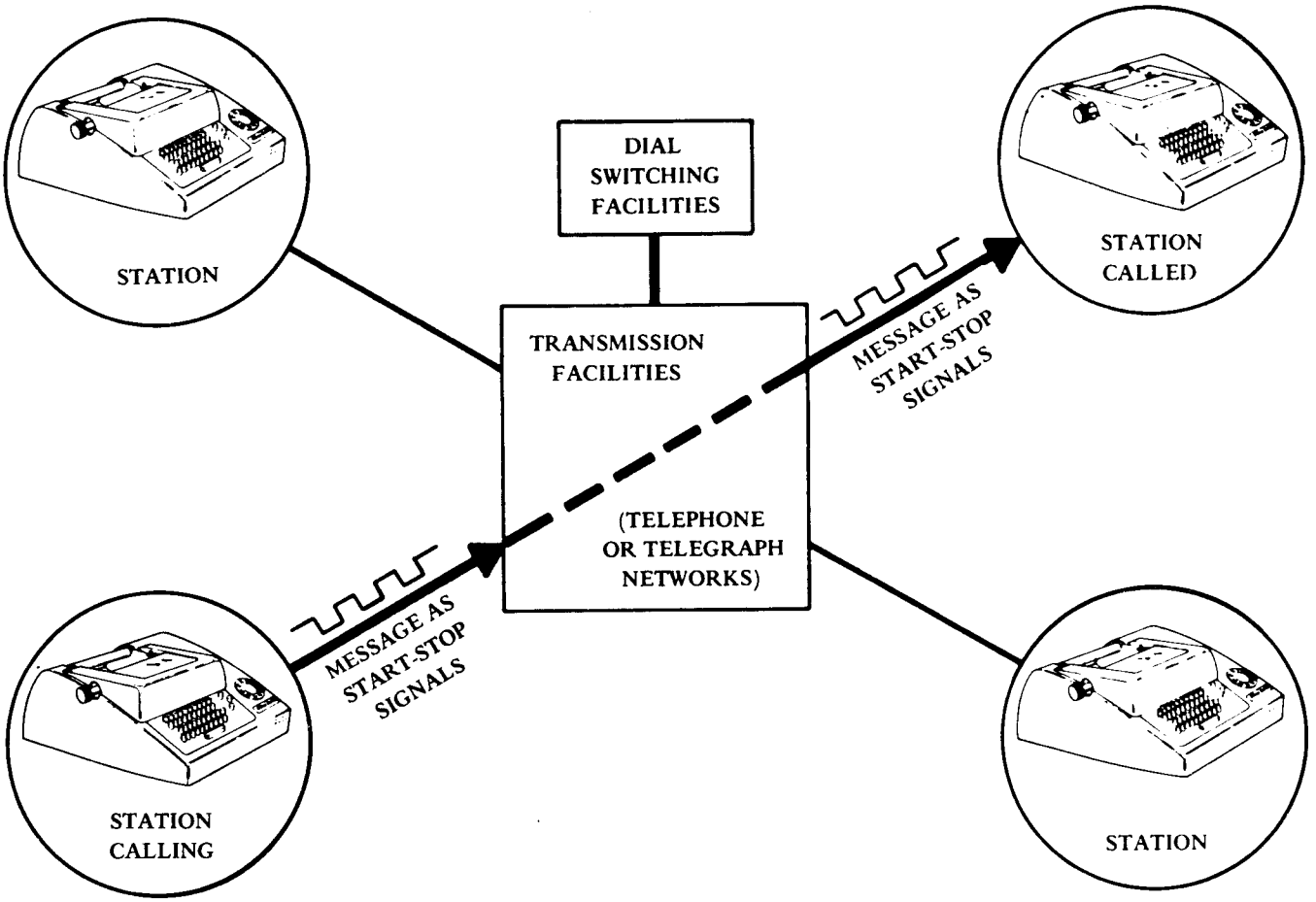


Figure 16 - Typical Applications

cation can proceed in either direction. This is indicated visually and/or audibly at the calling station.

Note: Variations of call control features provide unattended reception of calls.

5.03 Ordinarily the stations then identify themselves by the answer-back feature. The operator at the calling station can then type the message on the keyboard, or if it is an ASR set, can send it by perforated tape. In either case the teletypewriter set at the calling station translates the message to dc sequential start-stop signals which are applied to the transmission facilities. The teletypewriter sets at both the sending and receiving stations receive the signals and translate them to mechanical motions which print the message on continuous page copy or forms, and/or in the case of the ASR, perforate it in tape. If telephone networks are used, the dc start-stop signals are converted to tone frequencies for transmission and reconverted to dc start-stop signals for reception.

5.04 Finally, the operator at either station can terminate the call and return the set to its idle condition by operating the OFF control. There are a variety of OFF controls, including the EOT key on the keyboard, a control knob, or a pushbutton on the call control unit. A set may be equipped with one or two of these controls. In the case of an RO set, only one OFF control is necessary. In the case of a KSR and ASR set, the EOT control on the keyboard or the pushbutton on the call control unit may be used.

COMPUTER INPUT-OUTPUT (I/O) SET OPERATION

A. General Principles of Operation

5.05 Data is transmitted across the computer-teletypewriter link in a serial code form. The code consists of 11 elements. When a character is to be transmitted, the first element is a start pulse (always a space), followed by eight code elements which may be either marks or spaces and constitute the intelligence. The final two

elements are always both marking and are called the stop pulse. The start and stop pulses are used for synchronization purposes. Each code element takes 9.09 milliseconds, giving an aggregate rate of 10 characters per second or 110 baud. The standard code for the graphics is the ASCII. However, all 256 binary combinations may be punched, read, and transmitted from the paper tape. The information character codes for each component are as follows:

(a) Printer – 7 level (bits) ASCII (1967) insensitive to the 8th level.

(b) Keyboard – 7 level ASCII (1967) 8th level for even parity.

(c) Tape Reader and Tape Punch – 7 level ASCII (1967) with even 8th level parity and – up to 8 level mark/space bit character configurations.

5.06 The recording media consists of 1 inch wide tapes for punch and reader, and 8-1/2 inch wide roll paper for the printer. Friction feed is used for printer paper transport. Seventy-two characters are accommodated per line, and ten characters per inch. Vertically, printing is on a 6 lines to the inch spacing. The I/O teletypewriter has automatic carriage return/line feed, and operates from 115 volts ac, single phase. Sets are available for either a 60 hertz supply or a 50 hertz supply.

5.07 A switch on the teletypewriter, which is described later in this section is used to select local or remote mode operation. When in remote mode, the teletypewriter communicates with the computer, and is capable of receiving serial information with the computer selecting the teletypewriter components for printing only, paper tape perforation only, or simultaneous printing and tape perforating. The teletypewriter is also capable in remote mode of sending serial information with the computer selecting the tape (reader) sender, while locking the keyboard, or permitting manual entry from the keyboard. The sending line is wrapped to the receiving line to provide local copy in the local mode.

5.08 In the local mode, the teletypewriter line outputs are wrapped to its line inputs and all data transfer functions may be tested. This will be the prime service facility for the teletypewriters. In the local mode, the teletypewriters will also be used as keypunch machines to prepare program tapes for subsequent use.

5.09 An ASCII character (bell) transmitted from the control unit to the teletypewriter activates a bell in the typing unit, providing an audible alarm to the operator.

B. Functional Features

5.10 Printers:

(a) Friction feed, 6 lines per inch using 8-1/2 inch wide (maximum) rolled paper. Maximum paper roll diameter is 5 inches.

(b) Adjustable single or double line feed.

(c) One color printing (shipped with black ribbon), 10 characters per inch, upper case alpha characters.

(d) Printers employ upper case foldover printing of 1967 ASCII lower case characters.

(e) Automatic CR (carriage return) LF (line feed) at the end-of-line after 72nd character. A two character buffer is required following the 72nd character if additional printing characters follow at or near 100 wpm.

(f) EOL (end-of-line) bell on 71st character; margin bell on 61st character.

(g) Remote "print suppression" solenoid (Figure 14) operated with circuitry to external connector.

(h) Low paper contact with circuitry to external connector.

(i) No functional contacts in the function box.

(j) One "TV" TP185523 typewheel.

5.11 Keyboards:

(a) ASCII (1967) and even parity generation.

(b) Remote "keyboard lock" solenoid (Figure 14) operated with circuitry to external connector. During the lock mode, character generating mechanism is blocked and the keylevers may be depressed.

(c) The keyboard is supplied in one basic layout: TP184771 keytop arrangement except "line feed" instead of "new line" as shown in Figure 7.

5.12 Tape Punches:

(a) Mechanical input from electrical printer selector mechanism.

(b) The "punch control" solenoid (Figure 14) is operated by circuitry to the external connector. In the local mode, the punch is controlled by the operator button in the set control switch assembly.

(c) Teletypewriter tape supply arrangement with low tape contact with circuitry to external connector.

5.13 Tape Reader:

(a) Clutch trip circuitry wired to external connector for remote control.

(b) Tight-tape/tape-out contact with circuitry to external connector.

C. Operator Controls

5.14 The operator controls consist of the following:

(a) Six pushbuttons with labels:

(1) Motor Off (locking) (White - not illuminated)

(2) Remote* (locking) (illuminated, white)

(3) Request* (momentary, and illuminated-green)

(4) EOM* (End of Message) (momentary) (White - not illuminated)

*Wired to external connector.

(5) Local (locking) (illuminated, white)

(6) Punch (momentary push on, push off; illuminated-white when on)

(b) Main power switch (push on, push off) controlling all primary power to the machine. Illuminated (red) when power is on.

Note: Tape reader's operating level must be in run position, tape properly positioned, and tape lid closed for remote control operation.

D. On-Line Output

5.15 In the remote mode, the teletypewriter will output serial information to the computer by two methods:

(a) Paper Tape Entry

(1) Operator places the message tape in the reader, securing the tape lid and positioning the reader control level to run.

Note: By placing the tape and securing the lid, the tape-out contact is closed and through its circuitry to the external connector the computer is informed that the tape reader is ready.

(2) Operator depresses the REMOTE key of the control keyset.

(3) Operator then depresses the REQUEST key initiating a bid to the computer.

(4) The computer will remotely operate the motor control relay starting the motor.

Note: The computer must pause for at least one second for motor start-up.

(5) The computer will then remotely activate the reader and receive the message.

(6) The motor should be stopped following the end of the read sequence.

(b) Manual Keyboard Entry:

(1) Operator depresses the REMOTE key, then the REQUEST key of the control keyset.

(2) The computer will remotely operate the motor control relay starting the motor.

Note: The computer must pause for at least one second for motor start-up.

(3) The computer will then remotely activate the REQUEST lamp of the control keyset, unlocking the keyboard and permit the operator keyboard entry. At the completion of the message, the operator will depress the EOM key thereby directly indicating to the computer that message transmission is completed.

(4) The motor should be stopped following the end of the keyboard entry sequence.

E. On-Line Input

5.16 In the on-line mode the teletypewriter will record serial information input from the computer as follows: With the control keyset selected to remote mode control, the computer can initiate a teletypewriter motor on condition after testing the low tape/low paper indication circuitry. The computer can select the method of recording, such as:

(a) Page copy only by directly suppressing punching.

(b) Punch tape only by directly suppressing printing.

(c) Page copy and paper tape.

Note: The timing rules described in Figures 17 and 18 must be adhered to during the above.

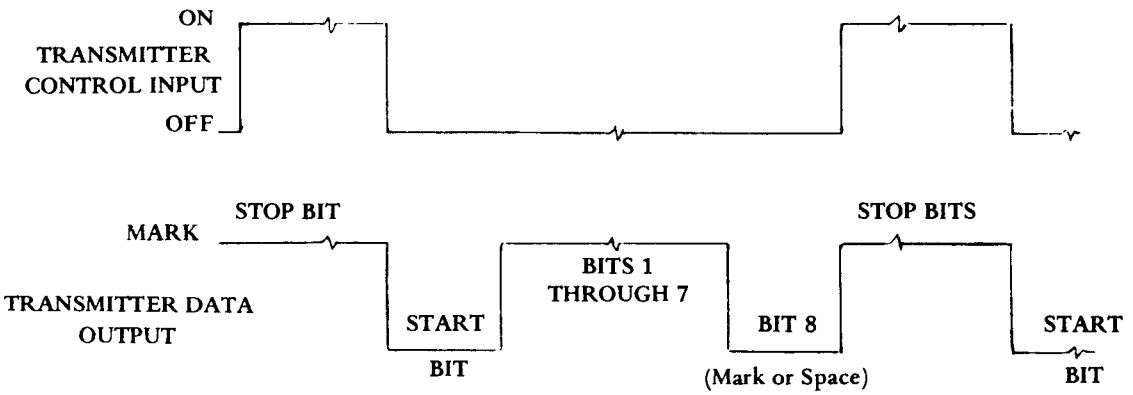


Figure 17 - Control Signal Format for Computer I/O Set
Tape Reader and Keyboard Transmitter

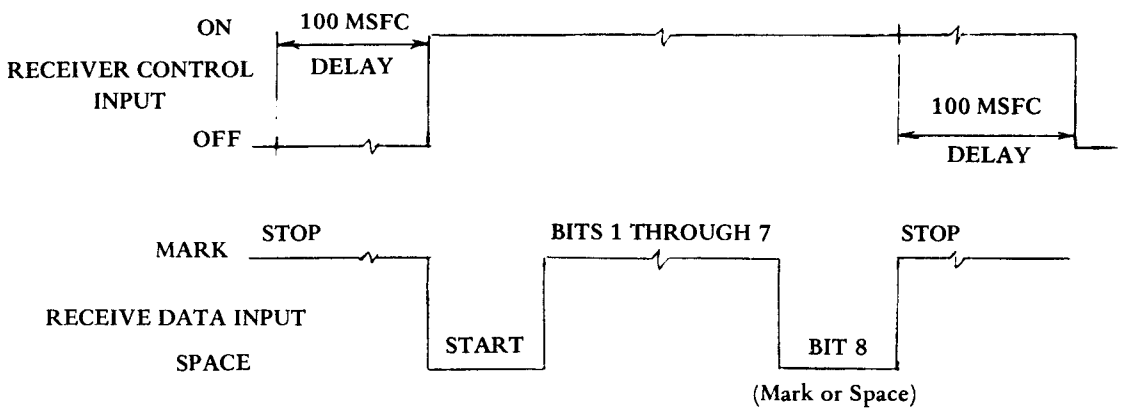


Figure 18 - Control Signal Format for Computer I/O Set
Tape Punch and Page Printer Receivers

F. Off-Line Operation

5.17 With the control keyset selected to local mode control, the teletypewriter motor is turned on. The operator can prepare message tapes from the keyboard with simultaneous page copy. Tapes can be edited by reading the tapes while recording on-page copy.

Note: The teletypewriter is arranged with all the basic component units contained within a subbase and the equipment cover. The customer must provide access for the chad container and tape loop of table mounted sets. A label affixed to the rear of the teletypewriter base gives the code and serial number.

6. TECHNICAL DATA

CAUTION: THIS EQUIPMENT IS INTENDED TO BE OPERATED IN A ROOM ENVIRONMENT WITHIN THE TEMPERATURE RANGE OF 40°F TO 110° F. SERIOUS DAMAGE TO IT COULD RESULT IF THIS RANGE IS EXCEEDED. IN THIS CONNECTION, PARTICULAR CAUTION SHOULD BE EXERCISED IN USING ACOUSTICAL OR OTHER ENCLOSURES.

33 SETS

6.01 Except where indicated otherwise for the I/O set (6.06 thru 6.33), the following applies to the 33 line of equipment:

6.02 Speed: 100 words per minute
600 operations per minute

6.03 Transmission Code: 8 level start-stop signals with 11 unit transmission pattern.

6.04 Dimensions and Weights (Approximate)

(a) RO Set

Width	18-5/8 inches
Depth	18-1/2 inches
Height	8-3/8 inches
Weight	39 pounds

(b) KSR Set

Width	18-5/8 inches
Depth	18-1/2 inches
Height	8-3/8 inches
Weight	40 pounds

(c) ASR Set

Width	22 inches
Depth	18-1/2 inches
Height	8-3/8 inches
Weight	44 pounds

(d) Stand

Width	17-3/4 inches
Height	24-1/2 inches
Depth (at top of enclosure)	6-1/2 inches
Length of Feet	17-3/4 inches
Weight	12 pounds

6.05 Electrical Requirements:

Power Requirements: 115 volts ac ±10% 60 (or 50) hertz ±0.45 hertz, single phase

Signal Line Current: 0.020 or 0.060 ampere
Nominal Input to Selector: 0.500 ampere at 20 volts dc

Operating Margins:
All signal contacts and distributor:

Long Telegraph Loops: 0.015 to 0.070 ampere at 48 to 240 volts dc inductive

Short Telegraph Loops: 0.058 to 0.072 ampere at 16 to 22 volts dc resistive

COMPUTER I/O SET

A. Physical Characteristics

6.06 The overall set dimensions are 22-1/4 inches wide by 20 inches deep by 8-1/2 inches high. The weight of the set is 35 lbs. A 10-foot power cord is provided for 60 hertz sets and a 2-foot power cord is provided for 50 hertz sets. The computer interface cable is 2-feet in length.

6.07 Keyboard: The keyboard includes the TP186854 modification kit to add universal keyboard lock.

6.08 A low tape switch operates when the tape supply is down to approximately 1/8 inch of tape on the tape core periphery.

6.09 The I/O set control unit provides the electrical interconnection of the various terminal components, the interface, and control circuits. The unit consists of a circuit board, power supply, and operator control switches.

6.10 Safety Features: Service area voltages greater than 30 v ac and 60 v dc are shielded. Thermally hot components in the service area are also covered. Rotating gears and fans have shields which do not support combustion.

B. Input Power

6.11 The sets require a power source of 115 v ac ±10% at 50 or 60 hertz, ±0.75 hertz. Running current is less than 4 amps and starting surge is 15 amps maximum.

C. Electrical Characteristics

6.12 The teletypewriter 2-foot computer cable is terminated with a 20-pin connector.

6.13 The computer to teletypewriter interface signals are (Figure 19):

(a) From Computer: The teletypewriter responds to five control inputs (motor off, keyboard off, reader off, printer off, punch off), and a data input (receive data). The interface requirement for all six inputs is identical. An impedance of 125 ohms or less to computer ground is recognized as "off control input" or a space data input, where the current which must be sunk from the teletypewriter will cause less than 1.5 volts to appear across the 125 ohm impedance. An impedance greater than 50,000 ohms is recognized as an "on" control input or a "mark" data input, where a minimum of 3.5 volts and a maximum of 7.0 volts appears across the interface from the teletypewriter. The most negative voltage ever to appear on the interface is -0.5 volts.

	INPUT				OUTPUT			
	TTY On State		TTY Off State		TTY On State		TTY Off State	
	Max (Mark)	Least (Mark)	Max (Space)	Least (Space)	Max (Mark)	Least (Mark)	Max (Space)	Least (Space)
	+7.0 V	+3.5 V	+1.5 V	-0.5 V	+7.0 V	+3.5 V	+1.0 V	-0.5 V
Computer Impedance to Ground (ohms)	R > 50K		R < 125		450<R<550		450< R < 550	

Legend: Greater > Lesser, Lesser < Greater

Figure 19 - Voltages and Impedances of I/O Set Data and Control Leads

(b) To Computer: The teletypewriter provides six control outputs (punch available, printer available, reader available, request, EOM, and remote) and a data output (send data). The interface requirement for all seven outputs is identical. An available, request, EOM or remote (control output) or a mark on the data output is effected by the application, to a computer load to ground of 500 ohms ±5 percent, of from +3.5 to +7.0 volts for the TTY "On" state, or from -0.5 to +1.0 volts for the TTY "Off" state (Figure 19).

6.14 DC ground is isolated from frame ground within the teletypewriter.

D. Interface

6.15 A 20-pin connector is used for connection to the computer. The pin assignment is as follows:

A	Send Data (Out)	P	Punch Off
B	Receive Data (In)	R	Printer Available
C	Remote	T	Reader Available
F	Circuit Common	U	Motor Off
H	Reader Off	W	Keyboard Off
J	E.O.M.	D	Spare Terminal
K	Spare Wire	E	Spare Terminal
L	Request	S	Spare Terminal
M	Printer Off	V	Spare Terminal
N	Punch Available	X	Spare Terminal

E. Voltages and Impedances of Data and Control Leads

6.16 Refer to Figure 19 for both data and control lead voltages and impedances. Refer to separate wiring diagram package as shipped with equipment for all wiring diagrams and detailed circuit descriptions.

F. Data Leads

6.17 Data is transferred across the interface in a serial form. Each character consists of 11 elements, 9.09 msec. in length. Synchronization is achieved by using a two-element STOP bit (always marking) and a one element START bit (always spacing). Information is transferred by means of the remaining eight elements.

6.18 The circuit common (dc ground) is isolated from the frame ground within the teletypewriter.

Note: The following paragraphs outline the control signal format required by the teletypewriter.

G. Transmitter Control Signal Format for Tape Reader and Keyboard

Note: Refer to Figure 17 for input-output timing diagram.

6.19 In the idle state, the transmitter control signal is on the off state (control lead at ground). With its control signal off, a transmitter is disabled.

6.20 At any time, the computer may enable either transmitter (tape reader or keyboard) by switching the appropriate transmitter control (reader or keyboard) to the on (control lead HIGH) state.

6.21 Following the transmitter on command by some interval determined by the tape reader start-up time or the combination of the keyboard start-up delay and the time of keylever depression, the transmitter will respond to the on command by generating the START bit associated with the first character to be transmitted.

6.22 On recognition of the START bit the computer restores the transmitter control signal to the off state. The transmitter, having been started however, will not be affected by the off condition, continuing through the normal character cycle.

6.23 At the 8th information bit, the computer must decide whether it wishes transmission to stop or to continue. If transmission is to continue, the computer restores the transmitter control signal to the on condition and the cycle (beginning at 6.21) is repeated. If transmission is not be to continued the computer holds the control signal off and transmission will be terminated (ie, the transmitter output will remain marking).

H. Receiver Control Signal Format for Tape Punch and Page Printer

Note: Refer to Figure 18 for control and data input timing diagram.

6.24 In the idle state, the receiver control signal is in the off state (control lead at ground). With its control signal off, a receiver is disabled and will ignore any data input.

6.25 At any time, the computer may enable either receiver (or both) by switching the appropriate receiver control input (punch or printer) to the on (control lead HIGH). The switch to the on state must however be preceded by a 100 millisecond period during which the receiver data input is held marking (ie, off).

6.26 Following the shift of the control input to the ON state, data transmission can begin immediately.

6.27 At the end of the 8th information bit, the computer must decide whether it wishes a receiver to operate or to stop. If the receiver is to stop, the computer must switch the control signal to the off state. The switch to the off state must be followed by a 100 msec. period during which the receiver data input is held marking.

I. Motor Control

6.28 An on condition of the motor off lead must precede data (send or receive) by a minimum of one second. Continuously recurring motor on and off commands at short intervals may cause fuse failure due to surge current overheating. Overheating of the fuse can be alleviated by a one minute off interval.

J. Operating Modes

6.29 Depression of the power switch closes both sides of the power line activating both the 48 v dc and 24 v dc power supplies. This also activates the interface leads.

6.30 Depression of the LOCAL button causes the tape reader and keyboard output to be connected to the printer and punch. A PUNCH ON/OFF button is provided at the call control. A STOP-START-FREE switch provides manual reader control.

6.31 Depression of the REMOTE button (assuming connection to an active computer) causes the set to be in a full-duplex configuration. The tape reader and keyboard are capable of transferring data to the interface (send data) and the printer and punch will be capable of recording data from the interface (receive data). In remote, the computer will have complete control of each sending and receiving device.

K. Environmental Tolerances

6.32 The teletypewriter will operate under worstcase conditions within a temperature range of 40°F and 110°F, a relative humidity of 2 percent to 95 percent with the room air velocity between 5 and 55 feet per minute. Altitudes may vary from sea level to 10,000 feet.

6.33 Storage temperatures may range from minus (-) 40°F to 150°F with altitudes up to 50,000 feet.

7. VARIABLE FEATURES AND ACCESSORIES

7.01 The following features may be ordered for some sets and components in the Model 33 line of equipment. (Refer to Part 3 of this section and to the related parts sections.)

(a) Elapsed Time Indicator: This item is for use only on special Model 33 sets used for switched network service, 60 hertz printer sets containing a UCC3 or UCC4 call control unit.

(b) Intermediate Tape Storage Bin: This is for general use on ASR sets.

(c) Tape Guide for Folded Tape: For use on ASR sets.

(d) Mobility Casters: A set of casters for teletypewriter set.

(e) End-of-Line Bell Feature: Parts to provide typing unit with end-of-line bell 9 characters before the end of a 69 character line.

(f) Paper Supply Bin and Accumulating Shelf: For use on cabinets.

(g) Twelve (12) Spaces Per Inch Conversion Parts: For use on typing units.

(h) Manual Single or Double Line Feed Parts: Adds this feature to friction feed typing units not so equipped.

(i) Print Nonprint Mechanism: Provides this feature for ASR set typing units not so equipped.

(j) Perforator Interlock Mechanism: Provides this feature for ASR sets equipped with the UPE802 perforator and the print nonprint mechanism (see (i)).

(k) Dry Tape Perforator Operation Sets of Parts: Permits oiled tape reperforators to be operated with dry (unoiled) tape.

(l) Directory Holder: For use on ASR and KSR set cabinets.

(m) Keyboard Locking Mechanism: Provides keyboard locking for units not so equipped.

(n) Automatic Carriage Return and Line Feed Mechanisms: Provides this feature for friction feed printers not so equipped. (The 3300 Series Coded Sets and some sprocket feed printers are factory equipped with this feature.)

(o) Sprocket Feed 6 to 3 Line Conversion Parts: Converts the form feed rate from 6 to 3 lines per main shaft rotation.